**Thawing Acid Rain**

**Laboratory Report**

**Abstract:**

This experiment is being conducted in order to gain results that display whether a fast spring melt is more harmful than a slow spring melt. Acid rain can be present in three main forms; snow, ice and rain. As snow accumulates over the winter, there is a large buildup of frozen acidic water. The question which is trying to be answered by running this experiment is: does a slow spring melt and fast spring melt cause more harm on the natural environment each spring. My hypothesis is that a fast run off will produce a more acidic fluid that will travel back into the natural water systems and cause more harm than a slow run off. I state this because a fast run off will put higher levels of acidic liquid back into the environment at a faster rate without giving time for natural processes to occur which cleanse natural waters.

**Introduction:**

Acid rain is caused by pollutants which are emitted into our atmosphere through a variety of ways. Green house gases are one of the number one ways in which pollutants are created which eventually reach the atmosphere where natural rain comes from. This is where the problem comes in. Acidic rain is created by the collection of pollutants’ that are the result of burning fossil fuels consisting of organic material. As acidic rain fall collects and forms as snow during the cold winter months, there can be serious environmental consequences for areas that are poorly buffered. Lakes and streams where spring thaw melt flows into can be greatly affected during the early spring season. This is a time when fish are spawning and their success depends on the natural water ways that flow steadily in the spring. If the natural water ways become to acidic, fertilization rates can be slowed down significantly. Although it is difficult to predict how quickly or slowly the snow melt run off will be, it is important to realize that this process has a very strong impact on natural fish populations.

**Materials:**

-Vinegar

-Ring stand

-pH meter

-Ice cube tray

-Clamp

-Pencil or marker

-Freezer

-Funnel

-Plastic wrap or zip lock bag

-Test tubes

-Graduated cylinder

-Thermometer

-Hand held blow dryer

**Procedure:**

1. Using any form of utensil, label six collection containers numbered 1-6

2. Use a graduated cylinder to measure 20 milliliters of water and pour it into the collection container. On the outside of the container, make a mark at lowest part of the top level of liquid and then pour out the water. Dry the container. Make a similar mark on the other five containers.

3. Make a data table with space to record the air temperature, time and pH of each sample to be collected.

4. Plug in a blow dryer and set the temperature and speed which your group has been assigned. Turn it on and hold a thermometer in the air stream for 30 seconds. Record the temperature in the data table.

5. Gather about 12 to 15 frozen vinegar cubes and place them in a large, dry funnel. Suspend the funnel using a ring stand and a clamp or support. Put container #1 under the funnel and record the time.

6. Immediately turn on the blow dryer and collect liquid until it reaches the outside mark you had previously made in step number 2. Make sure the blow dryer is the same distance away from the funnel during the entire experiment. As each container is replaced, record the time in the data table. Continue until all of the containers have been used or the ice is totaled melted.

7. Use a pH meter to measure the pH of each of the samples after they are collected. Record the pH values in the data table.

8. Make a graph of the group’s results by plotting pH versus time.

9. Discuss the results and their implications for understanding the potential impact of a fast spring melt on nearby streams.

**Results:**

Test tube #1: 5.1 pH level

Test tube #2: 5.0 pH level

Test tube #3: 4.9 pH level

Test tube #4: 5.1 pH level

Test tube #5: 4.6 pH level

Test tube #6: 4.2 pH level

**Discussion:**

It may seem that the answer to this question is straight forward, but it is not. The tricky or better said wrench in the mix is how two liquids freeze and melt. The chemical process that takes place when a solute and solvent interact is very unique and clearly impacts the outcome of the melting/freezing liquid. What this means is that a pure solute (in this case vinegar) freezes at a lower temperature than the pure solvent (in this case water). As the solvent freezes into a solid, it creates a more acidic solution because of the unfrozen solute that is present. The same exact process occurs when thawing takes place, just in the opposite order. As the frozen solution begins to melt, the solute begins to melt first and then the solvent will melt once the temperature increases. Since he solute melts first at a lower temperature, a liquid run off is created that is much more acidic then the entire frozen liquid solution. The solvent (water) will eventually melt, but it most likely will occur once the acid solute has melt and flowed away down stream into a natural water habitat. This being said, a slow thaw will produce low levels of acid run off over a long duration, and a quick thaw will produce high levels of acid run off for a short duration. The key idea when thinking about this is that during a quick thaw, yes there will be a large amount of acidic run off during a short duration, but the neutral solvent of water will also melt more quickly to act as a buffer for the natural habitats.

**Conclusion:**

It clearly depends on the total amount of acid rain fall that occurs during the winter months and never has the chance to flow into natural water ways until the spring thaw. The results that I gained from this experiment showed that over time the acidic level of the melting ice cubes continued to get more and more acidic. My results demonstrated that a quicker snow thaw will create more neutral water run off which will not be as harmful to the natural water habitats. A slow thaw will not allow for acidic water to flow into natural environments as quickly, but it also does not allow for the solvent (water) to melt and flow into the water ways acting as a buffer because it requires a higher temperature to melt than the acidic liquid.